

## FROZEN FRUIT FILLED PIE PRODUCTION

### CROSS-REFERENCE TO RELATED APPLICATION

The priority of the July 15, 2002 filing date of U.S. Provisional Application Serial No. 60/396,429 is hereby claimed.

### BACKGROUND

Frozen fruit pies are currently produced using one of three methods. In the first method, ingredients are mixed to create pie dough. The pie dough is then mechanically formed into pie shells in pie pans. The pie shells are then conveyed to a point on the production line where individually quickly frozen ("IQF") fruit is mechanically added into the pie shell. The shells with the IQF fruit are then conveyed to a point on the production line where a mixture of dry ingredients is added on top of the IQF fruit. The shells with fruit and dry ingredients are then conveyed to a point in the line where a mechanically formed sheet of dough is applied to the top of the pie. This top sheet of dough is then mechanically sealed to the bottom dough. The constructed pie is then conveyed through a freezer and to packaging stations. Finally, the frozen pie is packaged and moved to frozen storage for distribution.

In a second method, ingredients are mixed to create pie dough. The pie dough is then mechanically formed into pie shells in pie pans. The shells are conveyed to a point on the production line where a mixture of IQF fruit, liquid and dry sweeteners, minor ingredients, flavors and stabilizers is added by hand into the pie shells. The fruit mixture is made by adding fruit to a mechanical mixer. Then a liquid sweetener (e.g., high fructose corn syrup) is sprayed onto the fruit. Next dry ingredients, including sugar or other sweetener, starch, food gums, salt, flavors and minor ingredients are added to the mixer. The fruit coated with liquid sweetener is tumbled and mixed with the dry ingredients, which results in a relatively uniform coating of the fruit. Workers then measure the proper amount of fruit mixture into stainless steel bowls. Digital scales are used to control the weight of fruit mixture placed in each bowl. The bowls are then handed to workers who are stationed on the production line to "shape" the fruit and to ensure that the proper distribution of the filling occurs. The filled pie shells are conveyed to a point in the line where a mechanically formed sheet of dough is applied to the top of the pie. This top sheet of dough is mechanically sealed to the bottom dough. The constructed pie is conveyed through a freezer and then to packaging stations. Finally, the frozen pie is packaged and moved to frozen storage for distribution.

1 In a third known method of production, the fruit is cooked (whether IQF or not)  
2 with a combination of ingredients which imparts the appropriate characteristics to the  
3 finished product. Cooked pie fillings are sometimes referred to as slurry fillings.  
4 Cooking fruit prior to adding it to a pie shell produces a number of characteristics in the  
5 fruit including softening of fruit, damage to fruit during pumping and filling of the pie,  
6 loss or dulling of fresh fruit color, loss in fruit volume and marked changes in flavor.  
7 Additionally, when a fluid filling such a slurry fruit filling is deposited into a shell a  
8 certain amount of "leveling" occurs which creates a flat top crust when the pie is baked.  
9 In contrast, when an IQF pie, such as that described in the first and second methods  
10 above, is filled, the frozen fruit pieces remain mounded. The top crust exhibits the  
11 contours of the fruit pieces, both during and after the bake process. This appearance is  
12 consistent with a homemade pie, and importantly, this appearance denotes quality.

13 Quality pies can be produced using the three methods described above, however,  
14 each of the known prior art methods described above have various shortcomings. For  
15 example, the first method requires a very expensive starch. In addition, the process of  
16 applying the dry ingredients to the fruit can produce a process bottleneck in the  
17 manufacturing line. Due to the nature of handling (weighing and depositing) dry  
18 materials with unique flow properties, substantial capital investment is required in order  
19 to significantly speed up this first existing method. The second method described above  
20 is labor intensive and slow. Additionally, the time required to facilitate the mixing  
21 process and the mixing itself create a strong potential for the fruit to thaw before the filled  
22 pies can be conveyed into a freezer. Thawed fruit at this stage can create a serious quality  
23 problem. The third method requires the actual cooking of the fruit. As discussed, the  
24 cooking of the fruit decreases the quality of the pie by creating a flat top crust. The final  
25 presentation and appearance of the frozen fruit filled pie is an important feature of a  
26 quality product.

27 While the above described methods of manufacturing pies can generate quality  
28 pies, none of the methods provide a teaching of how to manufacture a quality pie that has  
29 all of the fruit and other ingredients evenly suspended throughout the pie filling.  
30 Therefore, there exists a need to address one or more of the above identified  
31 disadvantages of the current technology.

## 32 SUMMARY

33 In one aspect the Frozen Fruit Filled Pie Production is a method for manufacturing  
34 a frozen fruit filled pie. First, ingredients are mixed together to create pie dough. Then

1 the pie dough is formed into a pie shell. Next, IQF fruit is added to the pie shell. After  
2 adding the fruit a suspension is deposited over the IQF fruit in the pie shell. A top sheet  
3 of pie dough is applied over the suspension, IQF fruit and pie shell and sealed shut. The  
4 pie is then frozen in a freezer, packaged for shipment and stored in a frozen storage.

5 In another aspect, the Frozen Fruit Filled Pie Production is a frozen fruit filled pie  
6 manufactured by a process that begins with mixing ingredients to create pie dough. Next,  
7 the pie dough is formed into a pie shell and IQF fruit is added to the pie shell. The IQF  
8 fruit that is added to the pie shell remains frozen throughout the manufacturing process.  
9 Then a suspension is deposited over the IQF fruit in the pie shell. The suspension is used  
10 to create a stable suspension of the ingredients and IQF fruit. Next, a top sheet of pie  
11 dough is applied and sealed over the suspension, IQF fruit and pie shell. Finally, the  
12 frozen fruit filled pie is frozen, packaged and stored for distribution.

13 In another aspect, the Frozen Fruit Filled Pie Production is a suspension for  
14 creating a stable suspension of dry materials in a pie with a wide range of specific  
15 gravities. The suspension is manufactured with the following ingredients: a range of  
16 about 38% to about 88% liquid sweetener, or in other embodiments, a range of about 45%  
17 to about 80% liquid sweetener, or in other embodiments, a range of about 50% to about  
18 75% liquid sweetener, or in other embodiments, a range of about 55% to about 70%  
19 liquid sweetener, or in other embodiments, a range of about 60% to about 70% liquid  
20 sweetener; a range of about 5% to about 55% dry sweetener, or in other embodiments, a  
21 range of about 15% to about 45% dry sweetener, or in other embodiments, a range of  
22 about 25% to about 35% dry sweetener; a range of about 4% to about 15% food starch, or  
23 in other embodiments, a range of about 6% to about 12% food starch, or in other  
24 embodiments, a range of about 8% to about 10% food starch; a range of about 0.01% to  
25 about 5.0% food gum, or in other embodiments, a range of about 0.03% to about 4% food  
26 gum, or in other embodiments, a range of about 0.04% to about 3% food gum; a range of  
27 about 0% to about 8% oily material, or in other embodiments, a range of about 2% to  
28 about 6% oily material, or in other embodiments, a range of about 3% to about 5% oily  
29 material; a range of about 0% to about 4% flavorants, or in other embodiments, a range of  
30 about 1% to about 3% flavorants; and, a range of about 0% to about 3% minor  
31 ingredients, or in other embodiments, a range of about 0.5% to about 2.5% minor  
32 ingredients, or in other embodiments, a range of about 1% to about 2% minor ingredients.

33 The suspension exhibits a rapid reduction of viscosity when initially heated from  
34 frozen to about 120 degrees Fahrenheit in the bake cycle, and a rapid increase of viscosity

1 when exposed to temperatures above 120 degrees Fahrenheit. The liquid sweetener may  
2 be, for example, high fructose corn syrup, corn syrup, invert syrup, or saturated  
3 saccharide solution. The food gum may be, for example, alginate, carrageenan, locust  
4 bean gum, guar gum, xanthan gum, or gellan gum. The minor ingredients may be, for  
5 example, processing aids, preservatives, or colors, etc.

6 In another aspect the Frozen Fruit Filled Pie Production is a method for  
7 suspending frozen fruit filled pie ingredients of various specific gravities in a frozen fruit  
8 filled pie. The method is performed by mixing a first set of ingredients to form a  
9 suspension. The suspension is comprised of liquid, dry sweeteners, stabilizers, flavors  
10 and minor ingredients. The a second set of ingredients is mixed to create pie dough,  
11 which is then formed into a pie shell. Next, IQF fruit is added to the pie shell and the  
12 suspension is deposited over the IQF fruit in the pie shell. The suspension is used to  
13 suspend the IQF fruit and other ingredients in a uniform distribution upon baking of the  
14 pie. A top sheet of pie dough is then applied over the suspension, IQF fruit and the pie  
15 shell. The top sheet of pie dough is sealed to the pie shell, thereby sealing the frozen fruit  
16 filled pie. Finally, the pie is frozen.

17 The preferred embodiments are described below in the Figures and Detailed  
18 Description. Unless specifically noted, it is applicants' intention that the words and  
19 phrases in the specification and claims be given the ordinary and accustomed meaning to  
20 those of ordinary skill in the applicable art(s). If the applicants intend any other meaning,  
21 they will specifically state they are applying a special meaning to a word or phrase.

## 22 **DESCRIPTION OF THE DRAWINGS**

23 The detailed description will refer to the following drawings, wherein like  
24 numerals refer to like elements, and wherein:

25 Figure 1 shows a frozen fruit filled pie and the ingredients that are used to  
26 manufacture the pie;

27 Figure 2 is cross-sectional view of the frozen fruit filled pie showing the  
28 suspension of the IQF fruit and pie ingredients;

29 Figure 3 shows a mixing vessel used to mix the suspension used in the frozen fruit  
30 filled pie;

31 Figure 4 is a flow chart diagram illustrating the steps for the method of  
32 manufacturing a frozen fruit filled pie; and

33 Figure 5 is a flow chart diagram illustrating the steps for the method of  
34 manufacturing the suspension for the frozen fruit filled pie.

## 1 DETAILED DESCRIPTION

2 Uniform distribution of ingredients in the pie filling is advantageous to finished  
3 product quality. This is because consumers want each slice to have the same appearance  
4 and flavor profile. The fluid system of Frozen Fruit Filled Pie Production provides a  
5 medium that moves between the fruit pieces during the bake process. This fluid medium  
6 distributes the setting agents and flavors uniformly between the fruit. In order to achieve  
7 this uniform distribution and desired appearance, the Frozen Fruit Filled Pie Production  
8 utilizes a fluid suspension to overcome the shortcomings of the prior art, as detailed  
9 above. During manufacture the suspension is deposited over the IQF fruit prior to the  
10 sealing of the pie. Upon baking, the fluid suspension creates a stable suspension of the  
11 pie ingredients that all have a wide range of specific gravity.

12 With reference now to the FIGURE 1 of the drawings, there is illustrated therein a  
13 frozen fruit filled pie depicting the various ingredients, generally designated by the  
14 reference numeral 100. The frozen fruit filled pie is manufactured in a pie pan 102.  
15 During the manufacturing process pie dough is created. A portion of the created pie  
16 dough is then molded into a pie shell 104 and placed on top of the pie pan 108. Next,  
17 pieces of individually quickly frozen ("IQF") fruit 106 are added to the pie shell 104. It is  
18 important to note that during the manufacturing process of the frozen fruit filled pie, the  
19 IQF fruit remains frozen. Highest quality pies are made with Grade A IQF fruit where  
20 the fruit has remained frozen when put into the shell and is not thawed until the end user  
21 bakes the pie. This aspect of the frozen fruit filled pie is important because it avoids the  
22 shortcomings associated with systems and manufacturing processes where the fruit would  
23 either thaw or be cooked prior to the freezing of the pie.

24 The suspension 108 is deposited over the IQF fruit 106 in the pie shell 104.  
25 Uniform distribution of ingredients in pie filling is desired by consumers in finished  
26 product quality. This is because each slice should have the same appearance and flavor  
27 profile. The suspension 108 provides a medium that moves between the fruit pieces  
28 during the bake process. Thus, the suspension 108 distributes the setting agents and  
29 flavors uniformly where space between the fruit allows. A top sheet 110 of the pie dough  
30 is created and applied over the suspension 108, IQF fruit 106, and pie shell 104. The top  
31 sheet 110 is then sealed to the pie shell 104. The manufacture of the frozen fruit filled pie  
32 may be performed mechanically, or in alternative embodiments the manufacture of the  
33 pie may be performed manually.

1 With reference now to the FIGURE 2 of the drawings, there is illustrated therein a  
2 cross sectional view of a frozen fruit filled pie depicting the suspension of the various  
3 ingredients, generally designated by the reference numeral 200. As illustrated in  
4 FIGURE 2, a slice of the pie has been removed from a frozen fruit filled pie that has  
5 already been baked. The cross-sectional view of the pie shows that the IQF fruit 106 are  
6 suspended in the pie filling and evenly distributed throughout the inside of the pie. The  
7 suspension and even distribution of the fruit is made possible by unique characteristics of  
8 the suspension 108. The suspension 108 exhibits rapid reduction of viscosity when  
9 initially heated from frozen to about 120 degrees Fahrenheit. The rapid reduction of  
10 viscosity aids with the even distribution of the suspension within the pie. In addition, the  
11 suspension 108 exhibits a rapid increase in viscosity at temperatures above 120 F. The  
12 rapid increase of viscosity aids with the set of the pie and ability to serve slices properly.

13 The suspension also aids with the distribution of the starch and gums. The  
14 distribution of starch and gums by a fluid medium within the fruit prior to baking creates  
15 a unique effect upon the finished pie filling. The pie filling will have a glossy smooth  
16 appearance that the prior art methods fail to provide. Other benefits include moisture  
17 management in the finished baked pie. This prevents, among other problems, fruit juice  
18 from soaking the piecrust. During baking, juice is liberated from the fruit, which can  
19 cause starch and food gums to become lumpy and unappetizing. The use of the  
20 suspension aids in this regard as it produces a frozen fruit filled pie that is resistant to  
21 lumping when exposed to moisture.

22 With reference now to the FIGURE 3 of the drawings, there is illustrated therein a  
23 mixer used to mix the suspension 108 used in the frozen fruit filled pie, generally  
24 designated by the reference numeral 300. The formula for the suspension 108 may  
25 include:

- 26       ▪ a range of about 38% to about 88% liquid sweetener, or in other  
27       embodiments, a range of about 45% to about 80% liquid  
28       sweetener, or in other embodiments, a range of about 50% to  
29       about 75% liquid sweetener, or in other embodiments, a range of  
30       about 55% to about 70% liquid sweetener, or in other  
31       embodiments, a range of about 60% to about 70% liquid  
32       sweetener;
- 33       ▪ a range of about 5% to about 55% dry sweetener, or in other  
34       embodiments, a range of about 15% to about 45% dry sweetener,

1 or in other embodiments, a range of about 25% to about 35% dry  
2 sweetener;

3 ■ a range of about 4% to about 15% food starch, or in other  
4 embodiments, a range of about 6% to about 12% food starch, or  
5 in other embodiments, a range of about 8% to about 10% food  
6 starch;

7 ■ a range of about 0.01% to about 5.0% food gum, or in other  
8 embodiments, a range of about 0.03% to about 4% food gum, or  
9 in other embodiments, a range of about 0.04% to about 3% food  
10 gum;

11 ■ a range of about 0% to about 8% oily material, or in other  
12 embodiments, a range of about 2% to about 6% oily material, or  
13 in other embodiments, a range of about 3% to about 5% oily  
14 material;

15 ■ a range of about 0% to about 4% flavorants, or in other  
16 embodiments, a range of about 1% to about 3% flavorants; and,

17 ■ a range of about 0% to about 3% minor ingredients, or in other  
18 embodiments, a range of about 0.5% to about 2.5% minor  
19 ingredients, or in other embodiments, a range of about 1% to  
20 about 2% minor ingredients.

21 The liquid sweetener may be a high fructose corn syrup, corn syrup, invert syrup,  
22 or other saturated saccharide solutions. The use of a saturated saccharide solution  
23 provides the suspension with its unique characteristics. The food gum may be alginate,  
24 carrageenan, locust beangum, guar gum, xanthan gum, gellan gum, or other known gums.  
25 The oily material may be butter or margarine, or other similar material. The flavorants  
26 may be salt, spice, acids or flavors. The 0-3% "minor ingredients" may include  
27 processing aids, preservatives, or colors, etc. The process for making the suspension  
28 begins by adding liquid sweetener into a mixing vessel 302. The mixing vessel may be  
29 equipped with a high shear mixing element 304 and a stirring element 306. In one  
30 embodiment a Breddo Liquefier mixer is used. The Breddo Liquefier has a high shear  
31 element and a stirring element to adequately mix the ingredients to achieve the desired  
32 composition of the suspension. The dry ingredients are then blended and added to the  
33 liquid sweetener while the mixing 304 and stirring elements 306 are activated. The

1 mixing is continued until the dry ingredients are uniformly distributed into the liquid  
2 sweetener.

3 With reference now to the FIGURE 4 of the drawings, there is illustrated therein a  
4 flow chart diagram illustrating the steps for the method of manufacturing frozen filled  
5 pies using a suspension, generally designated by the reference numeral 400. The method  
6 400 begins by mixing the necessary ingredients to create pie dough 402. Next, a portion  
7 of the pie dough is formed into pie shells 404. Then, the IQF fruit is added to the pie  
8 shell 406. As noted above, the present method for manufacturing frozen fruit filled pies  
9 allows the IQF fruit to remain frozen throughout the manufacturing process.

10 Next, the suspension is deposited over the IQF fruit in the pie shell 408, and a top  
11 sheet of pie dough is added to the top of the suspension 410. The top sheet is then sealed  
12 to the pie shell 412. The sealing of the top sheet seals the frozen pie shut. Next, the pie is  
13 then conveyed to a freezer for freezing 414. After the pie is frozen, it is then conveyed to  
14 a packaging area 416 and packaged 418. Finally, the frozen pie is conveyed to a frozen  
15 storage 420.

16 With reference now to the FIGURE 5 of the drawings, there is illustrated therein a  
17 flow chart diagram illustrating the steps for the method of manufacturing the suspension  
18 for the frozen fruit filled pies, generally designated by the reference numeral 500. The  
19 method begins by metering liquid sweetener into a mixing vessel 502. As discussed  
20 above, the mixing vessel may be equipped with a high shear mixing element and a stirring  
21 element. Next, the dry ingredients are blended together 504. Then the dry ingredients are  
22 added to the liquid sweetener while the mixing and stirring elements are activated 506.  
23 The execution of the mixing and stirring elements is then continued until the dry  
24 ingredients are uniformly distributed into the liquid sweetener 508.

25 Use of a fluid to create a stable suspension of dry materials with a wide range in  
26 specific gravity is a remarkable advancement over the prior art. The manufacture of  
27 frozen fruit filled pies with a suspension accomplishes a combination of properties  
28 including, ease of manufacture and reasonable ingredient costs. For instance, liquid  
29 sweeteners are generally less expensive than dry sweeteners. And, when compared to  
30 prior art fruit pies, the amount of food starch that is used with the manufacture of frozen  
31 fruit filled pies with a suspension is reduced. Also, equipment that is used to rapidly  
32 meter and deposit fluids is relatively low in cost and simple to maintain. In addition, the  
33 suspension and methods disclosed herein provide for a much more sanitary process that  
34 requires fewer resources during cleanup.



1       The inventions set forth above are subject to many modifications and changes  
2 without departing from the spirit, scope or essential characteristics thereof. Thus the  
3 embodiments explained above should be considered in all respect as being illustrative  
4 rather than restrictive of the scope of the inventions as defined in the appended claims.